# USER GUIDE

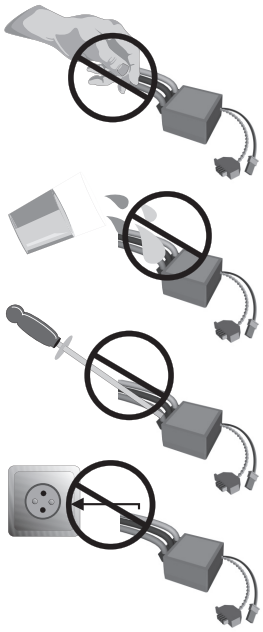
RA00186

**# 90500**

***BRUSHLESS + BRUSHED***
***over 5.5T (brushless)***
***over 7T (brushed)***

for distributor address see packaging **www.nosram.com**

## WARNING NOTES



- **IMPORTANT:** Never leave your RC model unsupervised when the battery is plugged in. If a defect occurs, it could set fire to the model or the surroundings.
- Never wrap your speed-control in plastic film or metal foil. In fact, make sure it gets enough fresh air.
- Avoid soldering longer then 5sec per soldering joint when replacing the power wires to prevent possible damage to the speed-control due to overheating of the components!

**IMPORTANT: Pay close attention** to the following points, as they will destroy the speed-control and **void your warranty.**

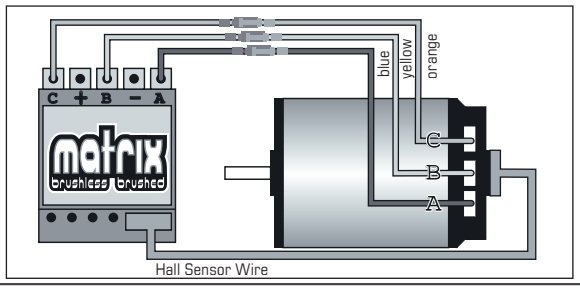
- Never solder a Schottky diode to the motor when you are using a MATRIX speed-control. A Schottky diode will destroy any brushless or forward/reverse speed-control.
- Never allow the speed-control or other electronic components to come in contact with water. Do not operate the speed-control in the rain. If you ever have to operate in the rain, protect your speed-control properly to avoid that water reaches the speedo.
- If the speed-control is connected to the motor, never run the motor directly with a separate battery or run-in device.
- Never connect the speed-control incorrectly or with reversed polarity.
- All wires and connections have to be well insulated. Short-circuits will destroy the speed-control. Pay special attention to the receiver- and switch wires.
- Never change the polarity of the receiver connector.
- Never open the speed control and never solder on the PCB (except on external solder-tabs).

## INSTALLATION

- Connect the speed-control to the receiver (position: channel 2)
- Be very careful with the correct wire sequence!

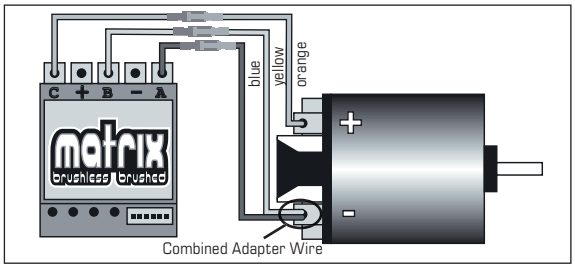
**BRUSHLESS MOTOR:**
The MATRIX comes pre-wired using common JST motor connectors. It's simply „plug & play" when you intend using a designated NOSRAM brushless motor, see picture below! You can, of course, also use the supplied optional power wires for a „hardwired" setup without connectors.

- MOT.A = blue wire
- MOT.B = yellow wire
- MOT.C = orange wire
- Connect the hall sensor cable to the speed-control and the motor.




**BRUSHED MOTOR:**
There are adapter wires supplied with the MATRIX, which allow simple and troublefree connection of a brushed motor, as shown in the picture below. You can, of course, also use the supplied optional power wires for a „hardwired" setup without connectors.

- MOT.A (blue) and MOT.B (yellow) will be the combined „minus" on the brushed motor.
- MOT.C (orange) wire will be „plus" on the brushed motor.




- Double-check all connections before connecting the speed control to a battery and ensure the switch is in „Off" position.
  **CAUTION:** If a connection is incorrect, it may damage the speed control.
- The speed control is now ready for setup.

Dear Customer,
thank you for your trust in this NOSRAM product. By purchasing a NOSRAM MATRIX Brushless AND Brushed speed-control, you have chosen one of the most advanced speed-control as of today, which is full of new design features such as:

- Brushless AND Brushed operation
- Small and lightweight
- Red metalised case
- 4-way Protection System
- 4 adj. Modes (motor type selection, punch, intial-brake and automatic-brake)
- Fwd/Brk/Rvs and Fwd/Brk Racing Mode
- Sensored Brushless Technology
- External solder tabs
- Intuitive DOMINATOR-style programming
- 100% Digital Technology

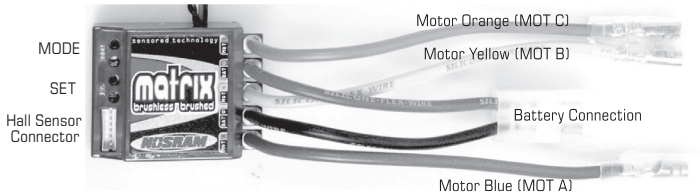
**Please read and understand these instructions completely before you use this product!**
**With operating this product, you accept the NOSRAM warranty terms**

## SPECIFICATION

| | | | |
|---|---|---|---|
| Brushless AND Brushed | yes | Typ.Volt.Drop (Brushed)* @20A | 0.026V |
| Forward/Brake/Reverse | yes | Rec. Motor Limit (Brushed)** | >7 turns |
| Case Size | 33x38x15mm | Rated Current (Brushed)* | 200A |
| Weight (excl. wires) | 24g | B.E.C. | 5.5V |
| Voltage Input | 4-7 cells (4.8-8.4V) | Drive Frequency | High |
| Typ.Volt.Drop (Brushless)* @20A | 0.035V / phase | Brushless System | Sensored |
| Rated Current (Brushless)* | 200A / phase | Protection-System | 4-way |
| Rec. Motor Limit (Brushless)** | > 5.5 turns | Connectors | Std Tamiya |
| 4 adj. Modes (Brushless/Brushed, Punch, Initial-brake, Auto-brake) | | | yes |

* Transistors rating at 25°C junction temperature. Specifications subject to change without notice.
**@ 6cells (7,2V)

## CONNECTIONS




**RECEIVER CONNECTING WIRE:**
This NOSRAM speed control is equipped with a NOSRAM Multicon receiver wire. As supplied, it will easily fit in all ordinary receivers.

**HALL SENSOR WIRE:**
This bi-directional multipole wire (which comes with the motor and NOT the speed-control!) connects the speed-control and the motor. Do not alter or modify this cable! There are replaceable hall sensor wires available:

- #92510 (20cm)
- #92520 (10cm)

**POWER WIRES:**
The MATRIX comes pre-wired using common Tamiya/JST battery connector and JST motor connectors. It's simply „plug & play" when you intend using a designated NOSRAM brushless motor! There are adapter wires included to connect the MATRIX to a brushed motor (see left chapter „Installation" for details). There's also a complete set of power wires included which allow you to use a „hardwired" wire setup. The unique splitted solder-tabs allow easy and convenient replacement of the power wires. Nevertheless some soldering skills are required. Talk to your local hobbyshop if you are concerned about replacing the wires yourself. There is a replacement power wire set available: #92505

**CAUTION:** Avoid soldering longer then 5sec per soldering joint when replacing the power wires to prevent possible damage to the speed-control due to overheating of the components!

## INSTALLATION TIPS

- Affix the speed-control using the supplied doubled-sided adhesive tape.
- Make sure there are enough cooling slits in the body. This will increase the performance and life of all the electronic components.
- Position the speed control where it is protected in the event of a crash.
- Install the speed control so that you have easy access to the plugs, connectors and buttons.
- Make sure there is enough clearance (about 3cm) between the speed-control, power-cable and antenna or receiver. Avoid any direct contact between power components, the receiver or the antenna. This can cause interference. If interference occurs, position the components at a different place in the model.
- The aerial should be run vertically up and away from the receiver. Avoid contact with any parts made of carbon fibre or metal. If the aerial is too long, don't coil up the excess length. It is better to cut it down to a length of about 35 cm. See also the instructions supplied with your radio control system.

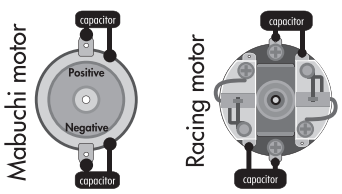
**IMPORTANT:** We recommend using the supplied heatsink on the MATRIX brushless + brushed speed-control in order to achieve best performance even under extreme circumstances. Clean the heatsink and stickerplate before you attach the thermal tape to obtain best possible heat transfer.

Because of the physical principles of brushless technology, the speed-controls do get a little hotter then brushed systems. Therefore it is required to let the speed-control cool down completely after every run. When running in extreme conditions (high ambient temperature, low-turn motors, high gear ratios, etc.), we recommend using Nosram's brushless colling set #92599, which includes an optional fan (perfectly sized 25x25mm, pre-wired) and a power-capacitor.

## MOTOR SUPPRESSION

**ONLY FOR BRUSHED MOTORS!** Motors with no capacitors or not enough capacitors may interfere with the speed-control. To avoid this, solder the supplied capacitors to your motor (see picture).

**CAUTION:** Never use Schottky diodes in conjunction with a brushless or forward/reverse brushed speed-control, e.g. the NOSRAM MATRIX brushless + brushed.



# SET-UP PROCEDURE

In setup mode, the MATRIX stores every step when you press the SET button. All the settings will be stored in the speed-controls memory even if the speed-control will be disconnected from the battery..

**TRANSMITTER SETTINGS**

Setup the following basic functions on your transmitter (if available):

| | | |
|---|---|---|
| Throttle travel | High ATV, EPA | maximum |
| Brake travel | Low ATV, EPA, ATL | maximum |
| Throttle exponential | EXP, EXPO | start with 0 |
| Neutral trim | SUB Trim | centre |
| Throttle trim | | centre |
| Serve reverse | Throttle reverse | any setting, don't change after set-up procedure! |

If your transmitter doesn't offer any of above functions, it's already in „basic setup" mode.

- Ensure, that the speed-control is not connected to the drive battery and is switched off.
- Remove motor pinion or ensure that the wheels of the model are free to rotate.
- Switch the transmitter on and set the transmitter throttle stick to neutral..

- Connect. the speed-control to the battery and switch the unit on.
- Press the SET button for at least 3sec, using the supplied plastic screwdriver.

- The SET LED flashes red and indicates that you entered setup mode (it continues flashing red until the setup is completed).

- Leave the throttle stick at neutral and press the SET button once.
  -> neutral setting is now stored. The MODE LED flashes green and the motor beeps.
- Hold the transmitter stick at full throttle and press the SET button once.
  -> the full-throttle setting is now stored and the MODE LED flashes red.
- Hold the transmitter stick at full brake and press the SET button once.
  -> the brake setting is now stored. The MODE- and SET-LED glow red.

- This completes the setup procedure and your MATRIX is ready to use.
- If you make a mistake during the setup procedure, don't worry: disconnect the battery for about 10sec and start again from the first step.
- At the end of each run disconnect the drive battery and switch off the transmitter afterwards.
- At the start of each run switch on the transmitter first, then connect the drive battery.

**CHECKING THE FUNCTIONS:**
If you run through the following functions with the throttle stick, you can check on the LED's that everything is setup correctly.

| FUNCTION | STATUS | MODE LED | SET LED |
|---|---|---|---|
| Neutral and normal brake | | off | red |
| Neutral and automatic brake | | red | off |
| Forward | partial throttle | green | off |
| Forward | full throttle | green | red |
| Brake/Reverse | partial brake/reverse | red | off |
| Brake/Reverse | full brake/reverse | red | red |

# SPECIAL FEATURES

**AVAILABLE MODES and PROGRAMMING THE MODES:**
The MATRIX features 4 different modes, which enable you to adjust motor type and application, motor power/driving feel, initial-brake and automatic brake to match YOUR special requirements precisely.

- How to get into „PROGARAMMING THE MODES": -> Press MODE button for at least 3sec.
- How to check the stored values: Count the number of flashes of the red SET LED (one flash equals value 1, two flashes value 2, etc.).
- How to change the value: Press SET button to increase value by one step.
- How to get to the next Mode: Press MODE button once.
- Table of settings, values and modes: See below (shaded/bold areas show „works default settings").

**MODE.1 (speed-control type selection):** The MATRIX contains 4 speed-controls in 1 and „Mode.1" allows you to select between the different „types" of speed-controls, which are built into the MATRIX.

| Motor Type | MODE LED | Value 1 | Value 2 | Value 3 | Value 4 |
|---|---|---|---|---|---|
| brushless | flashes green | **FWD/RVS** | Fwd/Brk | -- | -- |
| brushed | flashes green | -- | -- | Fwd/Rvs | Fwd/Brk |

**MODE 2 (drive-/punch-control):** Allows you to adjust the MATRIX to your likes. Either you run on slippery or high-traction surfaces, the MATRIX has a profile for you! Contains „Sportsman" profile with limited maximum RPM of 24'000 RPM, „Low Grip" profile with great driveability and „Modified" for unlimited power.

| Motor Type | MODE LED | Value 1 | Value 2 | Value 3 |
|---|---|---|---|---|
| brushless | flashes red | Sportsman | Low Grip | **MODIFIED** |
| brushed | flashes red | -- | Low Grip | Modified |

**MODE.3 (initial brake):** Allows you to set a certain level of "hand-brake effect", i.e. you can vary the minmum brake effect when you apply the brake.

| Motor Type | MODE LED | Value 0 | Value 1 | Value 2 | Value 3 |
|---|---|---|---|---|---|
| brushless | flashes green/red (alternate) | Linear | **SMOOTH** | Medium | Aggressive |
| brushed | not available | -- | (fixed) | -- | -- |

**MODE.4 (automatic brake):** Allows you to set a slight braking action which is applied in the neutral range. This enables you to simulate the feel of a brushed motor and also hold the throttle on longer when entering a turn. Your car also has more front traction with this setting. Tip: With Value 1, a brushless motor will have the same „natural" slowdown as a brushed motor without automatic brake.

| Motor Type | MODE LED | Value 0 | Value 1 | Value 2 | Value 3 |
|---|---|---|---|---|---|
| brushless | flashes greed/red (same time) | None | **SOFT** | Medium | Hard |
| brushed | not available | (fixed) | -- | -- | -- |

**INITIAL-/AUTOMATIC-BRAKE DEPENDENCY:** Only this unique feature will give you perfect brake-control. By not allowing lower initial-brake values then automatic-brake values, it ensures that the brake doesn't become less when you manually brake on the transmitter. This means, for example, if you have set automatic-brake on value 2 that you can not adjust value 0 or 1 on initial-brake (the set automatic-brake value becomes the minimum initial-brake value!).

**WORKS DEFAULT SETTINGS:** NOSRAM speed controls are supplied factory-adjusted. The defaults are the grey-shaded/bold areas in the Value columns above. If you loose track of the modes during the set-up procedure, you can reset the speed control to the NOSRAM works default settings. With the transmitter switched on, hold the SET button pressed while you switch on the speed control. This action returns the unit to the NOSRAM works default settings.

**CHANGING MODE SETTINGS WITHOUT THE TRANSMITTER:** At race events you usually do not have access to your transmitter. In this situation it is possible to adjust the MODE settings without the transmitter signal. All you have to do is disconnect the receiver lead from the receiver and connect the drive battery. You can now change the MODE settings as described in this chapter.

**SENSORED BRUSHLESS TECHNOLOGY:** The MATRIX speed-control uses the sensored brushless technology to communicate with the brushless motor. This allows the MATRIX to obtain perfect knowledge of the brushless motor's magnet position. This means perfect motor control at high and low RPM's, as well as perfect brake control. The sensored brushless motor feels just as smooth to drive as the brushed motor!

# TROUBLESHOOTING GUIDE

**EXPLANATION:** If there's no remark, the cause can be either with brushless and/or brushed motors. If „BM" is indicated, the cause only occurs when brushed motors are used.

| SYMPTOM | CAUSE | REMEDY |
|---|---|---|
| Servo is working, no motor function. | Speed-control plugged in incorrectly | Plug speed-control in Ch 2 |
| | Overload protection activated | Allow speed-control to cool down |
| | Wiring problem | Check wires and plugs |
| | Motor defective | Replace motor |
| | BM - Motor brushes stuck | Check that brushes are moving freely |
| | Speed-control defective | Send in product for repair |
| No servo and no motor function. | Speed-control plugged in incorrectly | Plug speed-control in with correct polarity |
| | Crystal defective | Replace components one by one. |
| | Receiver defective | |
| | Transmitter defective | |
| | Speed-control defective | Send in product for repair |
| Motor runs in reverse when accelerating forward on the transmitter. | Throttle stick polarity at transmitter changed while driving | Repeat set-up procedure |
| | BM - Motor connected incorrectly | Connect motor correctly |
| Insufficient performance. E.g. poor brake power, reverse power, topspeed or acceleration.. | Motor pinion or gear ratio too long. | Use smaller motor pinion/shorter gear ratio |
| | Transmitter settings changed after set-up | Repeat set-up procedure |
| | BM - Motor worn out | Maintain motor |
| | Motor defective | Replace motor |
| | Speed-control defective. | Send in product for repair |
| Speed-control overheats or switches off frequently. | No heatsink installed | Install heatsink |
| | Motor stronger than motorlimit or input voltage higher too high | Use only motors within motolimit and use batteries according to the specifications of the speed-control |
| | Motor pinion or gear ratio too big | Use smaller motor pinion/shorter gear ratio |
| | Drive train or bearing problems. | Check or replace components. |
| | Model used too often without cool-down periods | Let speed-control cool down after every run |
| | Extreme conditions | Use additional cooling fan |
| Motor never stops, runs at constant slow speed | Transmitter settings changed after set-up | Repeat set-up procedure |
| | Humidity/water in speed-control | Immediately unplug and dry speed-control |
| | Speed-control defective | Send in product for repair |
| Radio interference | BM - Motor suppressors not sufficient | Solder capacitors to motor |
| | Receiver or antenna too close to power wires, motor, battery or speed-control. Receiver aerial too short or coiled up | See „Installation Tips" and „Installation" |
| | Receiver defective, too sensitive; transmitter defective, transmitter output power too low, servo problem | Replace components one by one Only use original manufacturers crystals |
| | Poor battery connection | Check plugs and connecting wires |
| | Transmitter batteries empty | Replace / recharge transmitter batteries at regular intervals |
| | Transmitter antenna too short | Pull out antenna to full length |

**4-WAY PROTECTION SYSTEM:** This unique monitoring software is the perfect protection for the MATRIX speed-control against short-circuits (motor), overload and overheating. If your speed-control is ever faced with overload, the motor function is switched off for protection and the SET LED will flash to indicate the overload, although the steering function is maintained. Wait a few minutes to allow the speed-control to cool down.
Should you accidentally select one of the brushless motor modes while a brushed motor is connected to the speed-control, or vice versa, the MATRIX will warn you of this error by turning on the red SET LED and alternatively flashing red/green on the MODE LED. If the speed-control switches off frequently, either the motor used is too strong, the motor pinion is too big or you are using full brake too often. You can improve this by using the supplied heatsink or by obtaining the optional Nosram fan (#92599).

**POWER CAPACITORS:** We recommend the use of a power capacitor (as included in Nosram's brushless cooling set #92599), when using the MATRIX speed-control. Power Capacitors improve punch and offer additional protection for the speed-control. Simply connect the power capacitors at BAT+ (Red) and BAT- (Black) on the MATRIX's soldering tabs.

**REPAIR PROCEDURES / LIMITED WARRANTY**

All products from NOSRAM are manufactured according to the highest quality standards. NOSRAM guarantees this product to be free from defects in materials or workmanship for 90 days from the original date of purchase verified by sales receipt. This limited warranty doesn't cover defects, which are a result of normal wear, misuse or improper maintenance. This applies among other things on:

- Cut off original power plug or not using reverse polarity protected plugs
- Receiver wire and/or switch wire damaged
- Mechanical damage of the case
- Humidity/Water inside the speed control
- Mechanical damage of electronical components/PCB
- Soldered on the PCB (except on external solder-tabs)
- Connected speed-control with reversed polarity

With Limited Lifetime Warranty products, the warranty terms on the Limited Lifetime Warranty card do also apply.

To eliminate all other possibilities or improper handling, first check all other components and the trouble shooting guide before you send in this product for repair or warranty. Products sent in for repair, that operate perfect have to be charged with a service fee.

By sending in this product, you assign NOSRAM to repair the product, if it is no warranty or Limited Lifetime Warranty case. The original sales receipt including date of purchase needs to be included. Otherwise, no warranty can be granted. For quick repair- and return service, add your address and detailed description of the malfunction.

Our limited warranty liability shall be limited to repairing the unit to our original specifications. In no case shall our liability exceed the original cost of this unit. Because we don't have control over the installation or use of this product, we can't accept any liability for any damages resulting from using this product. By installing or operating this product, the user accepts all resulting liability.

The specifications like weight, size and others should be seen as guide values. Due to ongoing technical improvements, which are done in the interest of the product, NOSRAM does not take any responsibility for the accuracy of these specs.

**NOSRAM-DISTRIBUTOR-SERVICE:**

- Package your product carefully and include sales receipt and detailed description of malfunction.
- Send parcel to your national NOSRAM distributor (see www.nosram.com).
- Distributor repairs or exchanges the product.
- Shipment back to you usually by COD (cash on delivery), but this is subject to your national NOSRAM distributor's general policy.